

## ROUND 4

### TOSS-UP

1) PHYSICS *Multiple Choice* For a planet of uniform shape and density, the gravitational field half way to the surface from its center will be:

- W) twice that of the center
- X) 4 times that of the center
- Y)  $\frac{1}{4}$  that of the surface
- Z) half that of the surface

ANSWER: Z) HALF THAT OF THE SURFACE

### BONUS

1) PHYSICS *Short Answer* Sound frequencies below 16 Hertz are usually referred to by scientists as:

ANSWER: INFRASONIC

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### TOSS-UP

2) CHEMISTRY *Multiple Choice* Another name for heavy water is:

- W) ice
- X) salt water
- Y) deuterium
- Z) deuterium oxide

ANSWER: Z) DEUTERIUM OXIDE

### BONUS

2) CHEMISTRY *Short Answer* Many of the groups of elements in the periodic table have acquired common names. The elements in Group IA, with the exception of hydrogen, are called what?

ANSWER: ALKALI METALS

### TOSS-UP

3) BIOLOGY *Multiple Choice* Spallanzani, Pasteur, and Reti were:

- W) Italian scientists
- X) scientists involved with dispelling the theory of continuous generations
- Y) scientists involved with dispelling the theories of spontaneous generation
- Z) scientists who all began working as lens grinders

ANSWER: Y) SCIENTISTS INVOLVED WITH DISPELLING THE THEORIES OF SPONTANEOUS GENERATION

### BONUS

3) BIOLOGY *Multiple Choice* Which of the following is NOT one of Koch's (pronounced: Coke's) Postulates:

- W) the specific causative agent must be found in every case of the disease
- X) the disease organism can be isolated in impure culture
- Y) inoculation of a sample of the culture into a healthy susceptible animal must produce the same disease
- Z) diseased organisms must be recovered from the body of the inoculated animal

ANSWER: X) THE DISEASE ORGANISM CAN BE ISOLATED IN IMPURE CULTURE

(Solution: must be isolated in pure culture)

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### TOSS-UP

4) ASTRONOMY *Multiple Choice* The 29 ½ days it takes the Moon to complete an orbit around the Earth is called a:

- W) synodic month
- X) sidereal month
- Y) orbital month
- Z) solar month

ANSWER: W) SYNODIC MONTH

### BONUS

4) ASTRONOMY *Short Answer* What substance is responsible for Neptune's blue-green color?

ANSWER: METHANE GAS (ACCEPT: METHANE OR CH<sub>4</sub>)

### TOSS-UP

5) MATH *Short Answer* When a quadratic function is plotted on a typical graph, it assumes what shape?

ANSWER: PARABOLA

### BONUS

5) MATH *Short Answer* A country adopted a policy requiring all couples to continue having children until they had a girl, after which they must stop having children. How many children will the average family have and what will the sex distribution be?

ANSWER: TWO CHILDREN - ONE BOY AND ONE GIRL

(Solution: probability of n families having n girls is  $1/2^n$ . Probability of n families having n boys is  $1/2^n$  for I from 1 to n; as n gets large, probability of having n boys is 1)

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### TOSS-UP

6) EARTH SCIENCE *Multiple Choice* The Arctic Circle lies at which of the following latitudes:

- W)  $66\frac{1}{2}^\circ$  North
- X)  $90^\circ$  North
- Y)  $66\frac{1}{2}^\circ$  South
- Z)  $90^\circ$  South

ANSWER: W)  $66\frac{1}{2}^\circ$  NORTH

### BONUS

6) EARTH SCIENCE *Short Answer* What common type of paper contains substantial amounts of corundum and magnetite?

ANSWER: SAND PAPER (ACCEPT: EMORY CLOTH OR ALUMINUM OXIDE PAPER)

### TOSS-UP

7) GENERAL SCIENCE *Multiple Choice* Which of the following is NOT true concerning electric cars:

- W) a major challenge to this form of transportation is an efficient durable battery
- X) in 1900, more battery operated electric cars were built in the USA than gasoline engine cars
- Y) fleet cars are currently employing battery powered vehicles in many states
- Z) they are unsuitable for urban areas

ANSWER: Z) THEY ARE UNSUITABLE FOR URBAN AREAS

### BONUS

7) GENERAL SCIENCE *Short Answer* When an ideal line is extended into a region beyond where data exists on a graph, it is most typically called:

ANSWER: EXTRAPOLATION

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### TOSS-UP

8) GENERAL SCIENCE *Multiple Choice* Typically, printers are connected to which of the following ports:

- W) RTC
- X) PS/2
- Y) LPT
- Z) COM

ANSWER: Y) LPT

### BONUS

8) GENERAL SCIENCE *Short Answer* Generally, when a PC is turned on, the processor first looks at what area of the system to determine the system's configuration environment?

ANSWER: BIOS (ACCEPT: BASIC INPUT/OUTPUT SYSTEM)

### TOSS-UP

9) PHYSICS *Multiple Choice* AM radio stations have carrier frequencies of about:

- W) 530 megahertz to 1600 megahertz
- X) 680 megahertz to 1500 megahertz
- Y) 280 kilohertz to 1400 kilohertz
- Z) 530 kilohertz to 1600 kilohertz

ANSWER: Z) 530 KILOHERTZ TO 1600 KILOHERTZ

### BONUS

9) PHYSICS *Short Answer* Heat cannot pass from a cooler substance to a warmer substance without some other process being involved. This is an example of which law of thermodynamics?

ANSWER: THE SECOND LAW

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### TOSS-UP

10) CHEMISTRY *Short Answer* How many significant figures are there in the number 0.0036:

ANSWER: 2

### BONUS

10) CHEMISTRY *Multiple Choice* The Tyndall Effect can be demonstrated when light is passed through which of the following:

- W) a colloidal suspension
- X) supercritical water
- Y) aqueous solutions
- Z) mixtures of gasses

ANSWER: W) A COLLOIDAL SUSPENSION

(Solution: When a beam of light passes through a colloidal suspension, the large particles scatter the light and make the beam visible)

### TOSS-UP

11) BIOLOGY *Multiple Choice* Which of the following is most accurate about the pasteurization of milk:

- W) it makes milk taste better
- X) it kills all bacteria
- Y) it lowers the milk's pH
- Z) it reduces the population of bacteria

ANSWER: Z) IT REDUCES THE POPULATION OF BACTERIA

### BONUS

11) BIOLOGY *Short Answer* What is the most common physiological term used to denote how the body maintains a stable internal environment in the face of a constantly changing external environment?

ANSWER: HOMEOSTASIS

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### TOSS-UP

12) ASTRONOMY *Short Answer* In a search for "Planet X", this celestial body was found after astronomers had searched for an orbital disturbance of the planet Uranus:

ANSWER: PLUTO

### BONUS

12) ASTRONOMY *Short Answer* Sam Langley invented what instrument, which allows astronomers to measure the energy output of the Sun and other stars:

ANSWER: BOLOMETER

### TOSS-UP

13) Math *Multiple Choice* Which of the following is the mathematical term for a radical that expresses an irrational number:

- W) turk
- X) radicand
- Y) finical
- Z) surd

ANSWER: Z) SURD

### BONUS

13) MATH *Short Answer* Farmer John grows corn, tomatoes, potatoes and squash. He has only 2 fields for growing these products and cannot grow more than one product per field. How many planting combinations can be done in one season?

ANSWER: 10

(Solution: cc, ct, cp, cs, tt, tp, ts, pp, ps, ss)

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### TOSS-UP

14) EARTH SCIENCE *Multiple Choice* The Fujita Scale is used to classify intensities of:

- W) hurricanes
- X) tornadoes
- Y) earthquakes
- Z) volcanic eruptions

ANSWER: X) TORNADOES

### BONUS

14) EARTH SCIENCE *Short Answer* What is the only common mineral to be strongly magnetic other than magnetite:

ANSWER: PYRRHOTITE (ACCEPT: FeS OR IRON SULFIDE)

### TOSS-UP

15) GENERAL SCIENCE *Multiple Choice* A quick and simple method commonly used to inspect whether a metal is stainless steel is to:

- W) test if a magnet will be attracted to it
- X) test if it will react with sulfuric acid
- Y) pass a current through it and measure its resistance
- Z) measure its specific gravity

ANSWER: W) TEST IF A MAGNET WILL BE ATTRACTED TO IT

### BONUS

15) GENERAL SCIENCE *Short Answer* The second stroke in a four stroke engine is most commonly referred to as the:

ANSWER: COMPRESSION STROKE

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### TOSS-UP

16) GENERAL SCIENCE *Multiple Choice* Which of the following is NOT commonly thought of as an output device:

- W) video monitor
- X) scanner
- Y) printer
- Z) dot-matrix printer

ANSWER: X) SCANNER

### BONUS

16) GENERAL SCIENCE *Short Answer* The clock speed of a computer's CPU is measured in what unit?

ANSWER: HERTZ (ACCEPT: MEGAHERTZ OR GIGAHERTZ; MHz, GHz, Hz)



### TOSS-UP

17) PHYSICS *Multiple Choice* Which of the following is true about the index of refraction of a gas:

- W) it decreases with increasing density
- X) it increases with increasing density
- Y) it remains stable with changes in density
- Z) it is computed directly from Snell's Law

ANSWER: X) IT INCREASES WITH INCREASING DENSITY

### BONUS

17) PHYSICS *Short Answer* What is the dramatic increase in amplitude called when the frequency of forced vibrations on a body matches the body's natural vibration frequency?

ANSWER: RESONANCE

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### TOSS-UP

18) CHEMISTRY *Multiple Choice* Which of the following is true about the Kinetic Theory of Gases:

- W) gas particles do not attract or repel each other
- X) gas particles are attracted to the walls of the container they are in
- Y) the kinetic energy of gas particles is unrelated to temperature
- Z) gas particles attract and repel each other

ANSWER: W) GAS PARTICLES DO NOT ATTRACT OR REPEL EACH OTHER

### BONUS

18) CHEMISTRY *Short Answer* Name the two most abundant elements in the universe?

ANSWER: HYDROGEN AND HELIUM (ACCEPT: H AND He)  
(Solution: 99.9%)

### TOSS-UP

19) BIOLOGY *Short Answer* Where is intracellular fluid normally found?

ANSWER: INSIDE OF CELLS

### BONUS

19) BIOLOGY *Multiple Choice* The exchange of gases between blood and the tissue occurs normally in:

- W) venules
- X) arterioles
- Y) veins
- Z) capillaries

ANSWER: Z) CAPILLARIES

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### TOSS-UP

20) MATH *Multiple Choice* Systematic random sampling is to be used to select 5 addresses from an ordered list containing 500 addresses. A 1-in-100 systematic sample is used to select the 5 addresses. What is the chance that any specific address will be chosen:

- W) 1/5
- X) 1/100
- Y) 5/100
- Z) 5

ANSWER: X) 1/100

### BONUS

20) MATH *Short Answer* Give the product of  $(x + 7)^2$  in standard form:

ANSWER:  $x^2 + 14x + 49$

### TOSS-UP

21) EARTH SCIENCE *Multiple Choice* Which of the following is NOT an example of a silicate mineral:

- W) potassium feldspar
- X) quartz
- Y) garnet
- Z) apatite

ANSWER: Z) APATITE

### BONUS

21) EARTH SCIENCE *Short Answer* Which equinox marks the moment when fall begins in the Northern Hemisphere?

ANSWER: AUTUMNAL EQUINOX

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### TOSS-UP

22) GENERAL SCIENCE *Short Answer* The presence of what radioactive gas in houses poses a health risk for cancer of the lungs and may account for as high as 10% of lung cancer deaths in the USA.

ANSWER: RADON

### BONUS

22) GENERAL SCIENCE *Short Answer* What is the substance fresh coal becomes after heat has driven off all the elements that give off smoke and yellow flames, and the remaining substance then yields only a blue flame:

ANSWER: COKE

### TOSS-UP

23) PHYSICS *Multiple Choice* A major advancement in modern science began with the 1946 announcement in the journal "Science" that Oak Ridge Laboratory would make this available to qualified scientists:

- W) mass produced penicillin
- X) x-ray machines
- Y) radioactive isotopes
- Z) the first electron microscope

ANSWER: Y) RADIOACTIVE ISOTOPES

### BONUS

23) PHYSICS *Short Answer* Who determined that the square of a planet's period is proportional to the cube of its average distance from the sun?

ANSWER: KEPLER

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### TOSS-UP

24) CHEMISTRY *Multiple Choice* What is the pH of a solution with a hydronium ion concentration of  $1 \times 10^{-8}$  moles/dm<sup>3</sup> (read as:  $1 \times 10^{-8}$  moles per cubic decimeter)?

- W) 7
- X) 6
- Y) 8
- Z) 7.5

ANSWER: Y) 8

### BONUS

24) CHEMISTRY *Short Answer* What gas was discovered by Daniel Rutherford in 1772 by placing a mouse inside a bell jar, removing all the oxygen in the jar by burning a substance in it, and demonstrating the asphyxiation of the mouse:

ANSWER: NITROGEN (ACCEPT: N<sub>2</sub>)

### TOSS-UP

25) BIOLOGY *Multiple Choice* In the cell cycle, DNA synthesis occurs during:

- W) mitosis
- X) G1
- Y) G2
- Z) interphase

ANSWER: Z) INTERPHASE

### BONUS

25) BIOLOGY *Short Answer* In 1884, the Danish microbiologist Hans Christian Gram invented the gram stain, which delineates the difference between what two general types of bacteria?

ANSWER: GRAM POSITIVE AND GRAM NEGATIVE